ART. VIII.—*Some Remarks on Diseases Peculiar to Mountainous Regions.* By W. H. GARDNER, M D., Asst. Surgeon and Bvt. Major U. S. Army; Post-Surgeon Fort Union, New Mexico.

IN Professor Aitken's valuable work on the Science and Practice of Medicine he has given us many valuable facts regarding the distribution of disease on the surface of the globe, together with the effects of climatic influences upon the inhabitants, but as yet I have seen no work which treats of the diseases caused by the deficient atmospheric pressure and the rarefied air of mountainous regions, and it is to report some diseased conditions believed to be due to these causes that the present article is written.

If we consider air-breathing animals as complex machines, constructed to conform to certain physical conditions, and requiring a definite amount of oxygen and other elemental substances to carry on the constant changes required for the perfect working of all the varied parts of the machine, we would say without a second thought that no great change in these physical conditions (environment) could be made, or no great proportion of any one essential element abstracted, without seriously impairing, or stopping altogether, the working power of the machine. Yet observation teaches us that the tissues and organs of animal bodies are made of such mobile and transmutable material that interference with action in one part is speedily taken up and compensated for by increased or diminished action in some complementary or connected organ; or the organs themselves affected in a short time become changed in a certain measure to agree with the altered conditions; if the wind is not "tempered to the shorn lamb," the irritation to its skin causes increased flow of blood to the part and consequent hypertrophy, and eventually the shorn lamb becomes tempered to the wind. But this alteration in animal bodies to agree with altered surroundings (acclimatization) is only possible when the necessary changes can be brought about in so gradual a manner that the tissues and organs affected by them can accommodate themselves to these changes without so serious an interference with their functions or nutrition as to cause their inflammation or degeneration. If we take an Esquimau from the frozen shores of Greenland, and suddenly transport him to the hot, humid forests of Brazil, no one could reasonably expect him to live through the first year, and yet we are frequently witnesses to quite as radical changes being made by the orders of physicians, many of whom, without thinking of the vast difference in altitude, temperature, condition of atmosphere, etc., send their patients with phthisis from the Atlantic and gulf sea-boards, where the barometer stands at 30 inches, and the air is almost always saturated with moisture, to the changeable mountainous regions of Colorado, New Mexico, and Arizona, where the barometer seldom stands higher than 24 inches, and the temperature frequently varies 40° in twelve hours, depending on whether the wind blows from the dry, parched plains of Texas, or from the snow-crowned summits of the Rocky Mountains; one of the best commentaries upon which practice is the following paragraph which we cut from a Colorado newspaper a short time since:—

> "Six human bodies, in metallic caskets, were shipped east yesterday on the Kansas Pacific train. To offset this, nine invalids arrived last evening."

If we take the superficial area of a man of medium size as equal to sixteen square feet, and the atmospheric pressure at fifteen pounds to the square inch, we will have a pressure on the body of 34,560 lbs.; now the atmospheric pressure is directly dependent upon the constitution of the air and the weight of the gases which compose it, and it can easily be seen that no great change can be made in the weight of these gases without altering the amount of pressure, and so causing serious alterations in the functions of respiration and circulation, both of which depend to a very great extent upon the simple physical conditions of the constitution, and weight of the atmosphere.

But the disturbance arising from the removal or loss of atmospheric pressure, though I believe the chief cause of hæmoptysis, epistaxis, and menorrhagia, yet seems to be less of an evil and one more quickly compensated for than the deficient oxygen in the rarefied air of great altitudes.

Every process of vitality manifested by animal bodies, not even excepting thought and volition, is evinced by the destruction of tissue-elements, the débris of which appear in the circulating fluid, chiefly in the form of carbonic acid, and for the removal of this poisonous compound the blood is subjected, at short intervals, to the action of the atmosphere, when it gives off its carbonic acid and absorbs oxygen in its stead. The air we breathe consists of nitrogen and oxygen in the proportion by volume of 79.1 of the former to 20.9 of the latter, and these proportions have been found to be constant and invariable over all parts of the globe, and at all elevations; the only essential difference between the air at the sea-level and that from mountainous regions being that the higher we ascend the less dense the air becomes, *i. e.*, the further apart the atoms composing it are held, and the greater volume of it there is required to give the same weight. If now of the dense atmosphere at the sea-level, it is necessary to make eighteen respirations per minute, and take into the lungs twenty cubic inches at each inspiration to furnish sufficient oxygen to the blood, and through it to all the tissues of the body, it can easily be seen that when the air is *less* dense, and contains *less* of each of the gases which compose it, there must be either a greater volume of air taken in at each inspiration, or a greater number of inspirations per minute to furnish an equal amount of oxygen, and if one or the other of these compensations be not made, symptoms of poisoning by carbonic acid soon make their appearance.

The symptoms of poisoning by this gas are described as follows:—

"The earlier symptoms are a sense of weight, uneasiness, or pain, often violent, in the head; ringing in the ears, giddiness, sometimes vomiting, a great disposition to sleep, a rapid loss of strength, so as to be unable to continue upright, a great difficulty of breathing, the senses are dull, and there is a partial or total loss of sensibility. In advanced cases, the breathing is occasionally stertorous, and froth issues from the mouth. Coma is perfectly established, interrupted briefly in some instances by delirium, and in others by slight convulsions."—*Beck's Med. Jurisprudence*, vol. ii. p. 153, 1863.

If now we compare this assemblage of symptoms with those that take place in persons who go quickly from a less altitude to a greater, either by climbing to the tops of high mountains, or by the less fatiguing method of ascending in balloons, we will find them almost identical with the added symptoms occasioned by the loss of atmospheric pressure—there is the same difficulty in breathing, the same feeling of fatigue, numbness or tingling in the extremities, ringing in the ears and intense headache, and from the loss of external pressure frequently hemorrhages from the mucous membranes of the air-passages.

The ascent of the balloon "Zenith" from Paris last spring, which resulted in the death of two of her crew, and the very narrow escape of the third, must be regarded as the "experimentum crucis" which demonstrates beyond a doubt that human beings cannot safely ascend to a height of 8600 metres without resorting to some *reliable* apparatus to supply oxygen for respiration, and also some appliance to counteract the great loss of pressure at that immense height. Opinion seems to be still divided as to the (efficient) cause of death in the cases of MM. Sivel and Croce-Spinelli, according to the Paris correspondent of the *London Medical Times and Gazette*. The Academy of Medicine attribute the deaths to the extreme rarefaction of the air, whilst the Academy of Sciences maintain that it was due to asphyxia; M. Gaston Tissandier, the only surviving one of the crew, coinciding in the opinion held by the Academy of Medicine. The principal facts noted in both the fatal cases were, "bleeding from the mucous membrane of the mouth and lungs, which was accompanied by extreme lassitude, and temporary paralysis of the respiratory muscles, which proved fatal."

There can be but little doubt that deficient oxygen, and deficient atmospheric pressure each had a share in producing the fatal termination.

From these preliminary remarks it will be apparent that the diseases *peculiar* to mountainous regions are either due to—

1st. Deficient atmospheric pressure, or,
2d. Deficient oxygenation of the blood.

Of those due to the first-named cause the chief are epistaxis, hæmoptysis, menorrhagia, and nasal and bronchial catarrh. They occur most frequently in persons who have recently come into the country from a lower altitude, and usually upon those days that the barometer stands the lowest.

Epistaxis is most frequently met with among young and vigorous adults. I have seen many cases of it among recruits coming into the country from the recruiting rendezvous in the Eastern cities; in some instances it is troublesome from the frequency of its recurrence, but is generally easily controlled by free purgation, low diet, etc.

Hæmoptysis is most common among patients with pulmonary consumption, who have come out to this country in search of health in obedience to the orders of physicians. In the first case I was called to attend it was rapidly fatal, the patient being dead before I reached him; in the next case alarming hemorrhage had set in whilst the patient was crossing the Raton pass on the main stage road between Los Animas, Colorado, and Fort Union, New Mexico, and had continued with but slight intermissions until he arrived at this post. When I first saw him he was pallid and almost bloodless, but the hemorrhage was still going on. I succeeded in checking it after a time with tinct. ferri chlor., and then informed him that his life depended on his getting to a lower altitude as soon as possible. In several other cases that have come under my observation their histories were not materially different from that last given; hemorrhage from the lungs had appeared shortly after reaching the altitude of 6000 feet. It should also be stated that in the *most*, if not *all* of these cases no hæmoptysis had appeared before reaching this altitude. I have a patient now under my charge—a young recruit from New Orleans—in whom hemorrhage from the lungs first appeared a few days after arriving at this post, and has recurred at intervals ever since whenever the barometer descends to the neighbourhood of 23 inches; in this case there is no history of inherited tendency to phthisis in his family, nor any evidence of tubercles in the lungs.

Menorrhagia is most frequently seen in plethoric, full-blooded women between the ages of thirty-five and forty years. I have attended a good many cases, and found it usually to subside readily upon the exhibition of ergot followed by purgations and low diet, though it seems liable to recur at each menstrual period. I am also of the opinion that the "Chilie," or Mexican red pepper, which is eaten in such quantities in this country, acts as a *vascular* stimulant to the uterus. I am very confident that I have seen it act as an irritant to the male bladder, and have known attacks of dysuria to follow its use.

Nasal and *Bronchial Catarrhs* are very prevalent at all seasons of the year; they seem to be partly due to deficient atmospheric pressure, and partly to the constant winds that keep the air filled with particles of irritating dust, frequently of a highly alkaline nature. Both diseases are exceedingly unmanageable and exceedingly prone to return upon the least exposure.

The diseases arising from *deficient oxidation of the blood* are—

Paralysis, rheumatism, and perhaps also typhoid fever.

The form of paralysis is unusual, and it may not be uninteresting to describe the symptoms as they appeared in my own case.

Shortly after arriving at this post (Fort Union, N. M.) I was attacked with fulness of the head, ringing in the ears, mental hebetude, confusion of ideas, dizziness, and headache. Thinking these symptoms might be caused by constipation of the bowels, torpidity of the liver, or dyspepsia, I took a mercurial cathartic and followed it up with a dose of Rochelle salt. This relieved the oppression for a day or two, but it soon returned, the dizziness and confusion of ideas increased, and a feeling of numbness and tingling commenced in the fingers of the left hand and gradually extended until it involved the whole left side, even the muscles of the tongue being affected so that I could not articulate; there was also oppression of breathing, throbbing of the carotids, and slight dilatation of the pupils, with a pulse of 80, and tolerably full. The only medicine at hand was a bottle of chloroform, and, thinking the symptoms might be due to spasm of the cerebral or pulmonary vessels, I poured a drachm or two upon my handkerchief and inhaled it, when the disagreeable symptoms promptly subsided. The next day I mentioned my case to Dr. M——, U. S. A., who was here at that time, and, thinking the trouble might be caused by malaria, he advised me to commence quinia and arsenic, which I at once did, taking twelve grains of quinia and one-tenth of a grain of arsenic each day; but in the course of five or six days, while under the full influence of these medicines, I had another attack in all respects similar to the first, coming on after a hearty dinner, which was relieved by an active emetic. Shortly after this second attack I was called to attend a case of midwifery at Mora (a little town in the mountains, fifteen miles to the N. W. of the post, and considerably higher in altitude). The woman was delivered without difficulty, and I had been in bed and asleep for more than an hour when I was awakened by a third attack, which was more prolonged and severe than either of the others. Upon this occasion I inhaled chloroform, I took ipecac, bromid. potass., brandy, and indeed almost all the articles of the materia medica that I had with me, but with little or no good effect; the symptoms, however, gradually subsided and went off completely by morning. It was only after this third attack that I discovered the disease was due to imperfect oxidation of the blood, and commenced a rational treatment.

The next case was that of a lady, aged 35 years, the wife of an army officer passing through the post. A few hours after arriving here she was seized with difficulty of breathing, headache, dizziness, and confusion of ideas; numbness and tingling commenced in the righ hand and foot, and gradually increased until there was more or less anæsthesia over the entire right side of the body; the paralysis did not at first affect the nerves of *motion*, for she could move either hand or limb when requested to do so; there was also throbbing of the carotids, flushed face, and widely dilated pupils on both sides, and a pulse of 76 and tolerably full; the tongue was clean and red, but was protruded with hesitation and difficulty, was not curved to either side. The anæsthesia of the right side gradually passed into *clonic* spasm of the muscles of the leg and arm, and eventually subsided in two or three hours under the use of derivative sinapisms to the wrists and ankles, and an emetic of ipecac followed by ten grain doses of chlorate of potass. every hour in two ounces of water—there was no history of uterine disease, hysteria, or epilepsy in this case, nor was there any return of the disease after leaving this post.

In the third case the symptoms were more or less apoplectiform; still it is here cited because I believe the origin of the disease to have been the same.

I was sent for at 2 o'clock A. M., to attend at the hotel here a man of about forty years of age, and of rather robust and healthful appearance; he was lying on the left side in a deep stupor and breathing stertorously; the pulse was 84 and rather full; the pupils of both eyes were closely contracted, and a bloody mucus was issuing from his mouth. He seemed insensible to irritants, such as pricking or pinching, and only moved the toes slightly when the sole of the foot was tickled. The history of the case threw but little light upon the subject. He was known *not* to be an epileptic, he was a temperate and even abstemious man, and was known to have gone to bed perfectly sober; there was no smell of liquor, laudanum, chloroform, or any other narcotic on his person or about the room; the only facts that seemed to have any bearing on the case were that he had arrived at Fort Union only two days before from Cincinnati—and that he had eaten a hearty supper before going to bed. He recovered perfectly in a day or two under the use of derivative sinapisms, free purgation by croton oil, and full doses of potass. chloratis largely diluted with water.

The cases above cited are only specimens of the many that have come under my notice since I have been in this country. Sometimes the disease is of very mild form, and is limited to a partial anæsthesia of one or other extremity, and I have seen *two* cases in which it went no further than the hand and forearm of one side; in others again it is at once fatal, as in the case of General G——, U. S. Army, who died of this disease in Santa-Fe, New Mexico, in January of the present year; in still other cases, after the alarming symptoms have somewhat subsided, some portion of the cerebro-spinal system is found to be permanently impaired. A short time since a patient, who had been sent to this country on account of his health, came to consult me about "a kind of paralysis that had come on since he came here," which proved to be *progressive locomotor ataxia*, and I have now under treatment a case of aphasia, the result of a stroke of paralysis which occurred here last June.

Rheumatism is exceedingly common, not only among persons who have recently come into the country, but also among the indigenes. It is most frequently seen of the subacute type, though the acute articular form is by no means rare; so far but one case has come under my personal observation in which there was any cardiac complication. In this instance there was a well-marked endo-cardial murmur with the first sound of the heart, and subsequent symptoms of embolism of the profunda femoris of the right side.

Typhoid fever is the great scourge of the Mexican towns; it occurs among the youth and young adults of both sexes, and is usually complicated with pneumonia. A form of this fever not materially different from the well-recognized type, is frequently met with among mountaineers and miners, called mountain fever; in the only case in which I had an opportunity of making an autopsy, I found the usual lesions of typhoid.

In all of these diseases one essential element in their causation is deficient oxidation of the blood, and to supply this deficiency the treatment should be in a great measure directed. In the paralysis we should bleed without hesitation if the pulse indicates that it is necessary to reduce the vascular tension in order to prevent the giving way of a vessel and injury to the brain or spinal cord, but I believe this will seldom be found necessary. Theoretically the most speedy and efficacious remedy would be the inhalation of oxygen gas. In a communication of M. Paul Bert to the French Academy two years ago, detailing some experiments made upon himself in regard to the effects of changes of barometric pressure, he states that "with a mixture of 45 per cent. of oxygen he could bear without injury, a pressure of only 338 millimetres, which corresponds to the height of Chimborazo, and with 63 per cent. he was able to stand 250 millimetres (less than ten inches)."

Again, in poisoning by chloroform, no remedy has been found more quickly efficacious than inhalations of oxygen; but as the diseases here treated of usually occur in those mountainous and inaccessible localities where oxygen *per se* can rarely be obtained, we have to furnish it to the blood through the stomach, and I believe the best medicine for this purpose in the majority of cases is the chlorate of potass.; I am confident that I have seen this salt exert a marked benefit over the paralysis in less than six hours. When, however, the blood is plentiful but of poor quality, and lacking in red corpuscles, we must resort to mineral acids, and particularly the nitro-hydrochloric, and also to the tinct. ferri chlor. In the rheumatism and typhoid fever found here, the nitro-hydrochloric will be found of great benefit. *If* these diseases are caused by an imperfect or interrupted retrograde metamorphosis of effete tissue from want of oxygen to carry on the necessary changes, by supplying the oxygen in an available form we only add the one link needed to complete the physiological chain, but whatever may be the *modus operandi* the *fact* of its beneficial action is undeniable.

I am well aware that the foregoing remarks will be received by many persons with surprise, for the mountainous region of Colorado, New Mexico, and Arizona has long been considered one of the most healthy regions on the continent, and especially a region where phthisis and other lung diseases were unknown, and while I grant that phthisis is rare among the indigenes, yet in my practice of only two years in New Mexico I have seen several undoubted cases, and I believe that any physician who has practised medicine in this region will agree with me in stating that pneumonia, bronchitis, and throat diseases, and also rheumatism and typhoid fever, are not only exceedingly prevalent even among the native inhabitats, but are also attended with a very high death-rate. How much of this sickness and mortality is due to climatic influence and how much to their manner of life is yet an open question and one not so easy to answer, and while I believe that imperfect oxidation of the blood acts as a constant and unavoidable source of disease, yet it must be recollected that all the dwellings in this country are made of sun-dried bricks (adobes), and all are more or less damp, and as to real healthful cleanliness, either of their persons or surroundings, it would seem that such an idea had never entered the minds of the inhabitants.

These remarks are necessarily crude and imperfect, partly from the limited field allowed for observation and partly from absence of any statistics, but I think a sufficient number of cases has been quoted to make it fully apparent that physicians have exercised too little care in sending patients to a country they know nothing about, and that thereby they have brought discredit upon themselves and the profession at large, and have caused the loss of many valuable lives.

Fort Union, N. M., March 7, 1876.

Art. IX.—*On Spasm of the Heart, as a Cause of sudden Death, and its Relation to Angina Pectoris.* By Frederick D. Lente, M.D.

C. B., aged 35 years, station agent of the H. R. R. Rd. Co., at Cold Spring, was taken sick about the eighth of April, 1875, and sent for me on the 10th. I diagnosed mild typhoid fever. He was never sufficiently ill to keep his bed all day, and had some relish for food all the time. Temp. 102° to 103°; pulse but slightly accelerated; bowels natural. He had a slight hacking cough almost from the first. After the lapse of a fortnight, his fever subsided, but he was quite feeble, and found that he had lost eighteen pounds in weight. He went out before it was prudent to do so, visited a sick brother in the city, returned the same day, and for two days endeavoured to attend to business. He had a relapse; the fever assuming the same mild course. Temp. 102°–103°. The cough was more annoying, and a mild anodyne expectorant mixture was prescribed. This was all the medication, except one mild cathartic and a simple tonic at the time of his relapse, when his appetite totally failed. This restored it to some extent, and he acquired some relish for his food.

May 3d, his wife informed me that he had a sudden attack in the afternoon. He had taken a little milk-punch, while sitting up in his chair,